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PRELIMINARY OPERATING AND MAINTENANCE INSTRUCTIONS FOR GROUND HYDRAULIC SYSTEM (B & C SERIES)

ZE-7-137

15 September 1958

Published by Support Publications
for the
HYDRAULICS GROUP
ENGINEERING DEPARTMENT

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CONVAIR-ASTRONAUTICS
CONVAIR DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO, CALIFORNIA

LIST OF EFFECTIVE PAGES

Total number of pages in this publication is 20 , consisting of the following:

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2-1 to 2-6	Original

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SECTION I

INTRODUCTION

1-1. INTRODUCTION.

1-2. This manual provides preliminary operating and maintenance instructions for the blockhouse hydraulic control panel associated with the XSM-65 missile B & C series. In addition it covers associated equipment connecting the control panel with the ground and airborne hydraulic systems. The instructions are based on information available on the date of publication and are interim in nature. The manual will be revised as additional information is developed through actual operating and maintenance experience at the factory and test sites. Complete reissues of the manual will be made periodically. Personnel concerned with the operation and maintenance of the system can contribute to the effectiveness of the revised manuals by forwarding any comments to the Hydraulics Design Group, or to Support Publications, Convair-Astronautics.

1-3. APPLICABLE DOCUMENTS.

a. ZM-7-252B, Preliminary Operating and Maintenance Instructions for the Hydraulic-Pneumatic Supply Unit Trailer Mounted.

b. ZE-7-111, Preliminary Operating and Maintenance Instructions for "B" Series Hydraulic Systems.

c. ZE-7-124 P.O.M.I. for "C" Series Airborne Hydraulic Systems.

1-4. SCOPE.

1-5. The blockhouse hydraulic control panel system provides a means of controlling and monitoring the ground and airborne hydraulic systems for checkout exercises or actual launchings.

1-6. DESCRIPTION OF SYSTEM.

1-7. The blockhouse hydraulic control system is composed of two primary sections described as follows:

a. Blockhouse Hydraulic Control Panel is a remotely located panel for controlling and monitoring the ground and airborne hydraulic systems.

b. Electrical Control System provides means for transmitting intelligence from the blockhouse hydraulic control panel to the hydraulic supply unit. In addition it provides means for transmitting information from ground and airborne hydraulic systems to the blockhouse hydraulic control panel.

c. Instrumentation provides means of changing hydraulic pressures and temperatures into electrical impulses that can be transmitted to the blockhouse hydraulic control panel.

1-8. DESCRIPTION OF MAJOR COMPONENTS.

1-9. GENERAL. The airborne hydraulic system is supplied, until launching, from two identical trailers. One trailer supplies the booster requirements while the other supplies the sustainer requirements. There are two sets of controls for the booster and sustainer supply systems. The controls in

each system operate in parallel, (see figure 1-1). The hydraulic supply system can be operated either from the local control panel or the remote control panel. When operated from the local panel the remote controls are deactivated and vice versa. However when remote indications are available on local or remote, the controls (remote and local) permit operation of the following:

a. Ground pump motor start and stop.
b. Bypass valve open and close.

1-10. POWER SOURCE. Commercial power (440-volt, 3-phase, 60-cycle) is furnished to the supply trailers from the pad facility control system. In case of commercial power failure, 3-phase, 440-volt, 60-cycle, 150-kw power is supplied from an emergency diesel generator to the tactical panel (TP18) through the automatic transfer switch. Twenty-eight volts dc for both local and remote control is furnished from the 440-volt, ac line by a conversion unit, located in each supply trailer.

CAUTION

To prevent damage to the hydraulic pump make certain the phase rotation is as shown in figure 1-2.

1-11. PNEUMATIC SYSTEM. (See figure 1-3.) The pneumatic pressure medium, helium, is routed to one hydraulic-pneumatic supply trailer through the pressurization control unit. The pneumatic system supplies gas at pressures up to 2200 psig to the engine manifold. This pressurized gas is used for valve control and airborne hydraulic reservoir pressurization. Just prior to launch, the internal helium supply is obtained from one of the airborne helium storage bottles for valve control. During flight, hydraulic reservoir pressurization is provided from the main fuel tank pressure sensing line.

1-12. LOCAL CONTROL PANELS. The local control panels as shown in figures 1-3 and 1-4 are located in hydraulic-pneumatic trailers 7-09241-1 or 7-09241-3. These panels are typical of both trailers and allow complete control of the hydraulic-pneumatic supply trailer.

1-13. BLOCKHOUSE HYDRAULIC CONTROL PANEL. (Also called the Remote Control Panel.) The blockhouse hydraulic control panel (see figure 1-5) contains the following controls and instrumentation:

a. Missile inlet pressure gage. This is a high pressure gage (0 to 4000 psig) that is controlled by a three position selector switch as shown in table 1-1.

Table 1-1. Pressure Gage Switch Indications

SWITCH POSITION	INDICATION
Booster	Booster section inlet pressure from a transducer located in the launcher.
Sustainer	Sustainer section inlet pressure from a transducer located in the launcher.
Off	Gage not energized.

NOTE

This gage although rated for 0 to 4000 psig will not register pressures greater than 3000 psig due to a gage saver installed in the pressure transducer.

b. Inlet Temperature Gage. This is a temperature gage (0°F - 200°F) with indication controlled by a five-position selector switch as shown in table 1-2.

Table 1-2. Temperature Gage Switch Indications

SWITCH POSITION	INDICATION
Missile	
Booster	Booster section inlet temperature from a transducer located in the launcher.
Sustainer	Sustainer section inlet temperature from a transducer located in the launcher.
Ground Pump	
Booster	Booster section inlet temperature from a transducer located in the booster hydraulic supply unit trailer.
Sustainer	Sustainer section inlet temperature from a transducer located in the sustainer hydraulic supply unit trailer.
Off	Gage not energized.

c. Missile Outlet Pressure Gage. This is a low pressure gage (0-150 psig) that is controlled by a three-position selector switch as shown in table 1-3.

Table 1-3. Outlet Pressure Gage Switch Indications

SWITCH POSITION	INDICATION
Booster	Booster outlet (return) pressure from a transducer located in the launcher.
Sustainer	Sustainer outlet (return) pressure from a transducer located in the launcher.
Off	Gage not energized.

NOTE

This gage although rated for 0 to 4000 psig will not register pressures greater than 3000 psig due to a gage saver installed in the pressure transducer.

d. Lights and switches for the booster hydraulic control panel function as shown in table 1-4.

e. Lights and switches for the sustainer hydraulic control panel function identically as shown in table 1-4.

1-14. REFERENCES.

1-15. APPLICABLE DRAWINGS.

a. 7-68126 - Console - Control Hydraulic.

Table 1-4. Booster Control Panel Functions

UNIT	DESCRIPTION
Panel Control	Green lamp is illuminated when hydraulic supply unit control switch is in the remote position.
Missile Pump Operating Light	Green lamp is illuminated when booster section missile pump is operating at a discharge pressure of 2300 ± 100 psig.
Ground Pump Operating Light	Green lamp is illuminated when hydraulic supply unit pump is operating.
Ground Pump Control Switches	Allow remote operation of the booster hydraulic supply unit pump.
Bypass Valve Lights	Amber lamp is illuminated when bypass valve is in "open" position. Green lamp is illuminated when bypass valve is in "closed" position.
Bypass Valve Control Switches	Allow remote operation of the booster hydraulic supply unit bypass valve.

b. 7-68631 - Diagram - Wiring, Console, Control, Hydraulic.

c. 7-68172 - Interconnecting Box - Hydraulic.

d. 7-65654 - Diagram - Schematic Hydraulic Control, Sycamore S-2.

e. 7-65695 - Diagram - Schematic Control Instrumentation.

1-16. EQUIPMENT LIST. A typical system is shown in table 1-5.

Table 1-5. Equipment List

ITEM	DESCRIPTION	REFERENCE	AN NO.
Z-2	Console control hydraulic	7-68126	----
P201	Plug	92-40005-002	3106E-32-7S
P101	Plug - part of trailer	68-107632-13S	----
P102	Plug - part of trailer		
P203	Plug Temp. XDRC. R311	92-40002-002	3106E-12S-3S
P204	Plug Press. XDRC. R313	92-40003-016	3106E-14S-7S
P205	Plug Press. XDCR. R312	92-40003-016	3106E-14S-7S
P206	Plug Temp. XDCR. R314	92-40002-002	3106E-12S-3S
P207	Plug Press. XDCR. R316	92-40003-016	3106E-14S-7S
P208	Plug Press. XDCR. R315	92-40003-016	3106E-14S-7S
TBH	Interconnecting Box Hydraulic	7-68172	----
----	Hydraulic Supply Trailer	7-09241-1 or -3	----
R311	Transducer (0-200) °F. Booster	89-05001-005	----
R312	Transducer (0-4000) psi Booster	7-06373-801	----
R313	Transducer (0-150) psi Booster	7-06373-5	----
R314	Transducer (0-200) °F. (Sustainer)	89-05001-005	----
R315	Transducer (0-4000) psi (Sustainer)	7-06373-801	----
R316	Transducer (0-150) psi (Sustainer)	7-06373-5	----
PS 1	Power Supply 28 Volts VDC	96-97012-001	----
Z150	Panel Calibrating Recording Meter	7-68231-819	----
Z151	Panel Calibrating Recording Meter	7-68231-821	----
Z154	Panel Calibrating Recording Meter	7-68231-827	---
Z155	Panel Calibrating Recording Meter	7-68231-829	----
R201	Resistor 422 Ω 1/8w	97-47062-001	----
R202	Resistor 422 Ω 1/8w	97-47062-001	----
R203	Resistor 422 Ω 1/8w	97-47062-001	----
M201	Missile Outlet Pressure	7-06294-803	----
M202	Inlet Temperature	7-06294-807	----
M203	Missile Inlet Pressure	7-06294-805	----

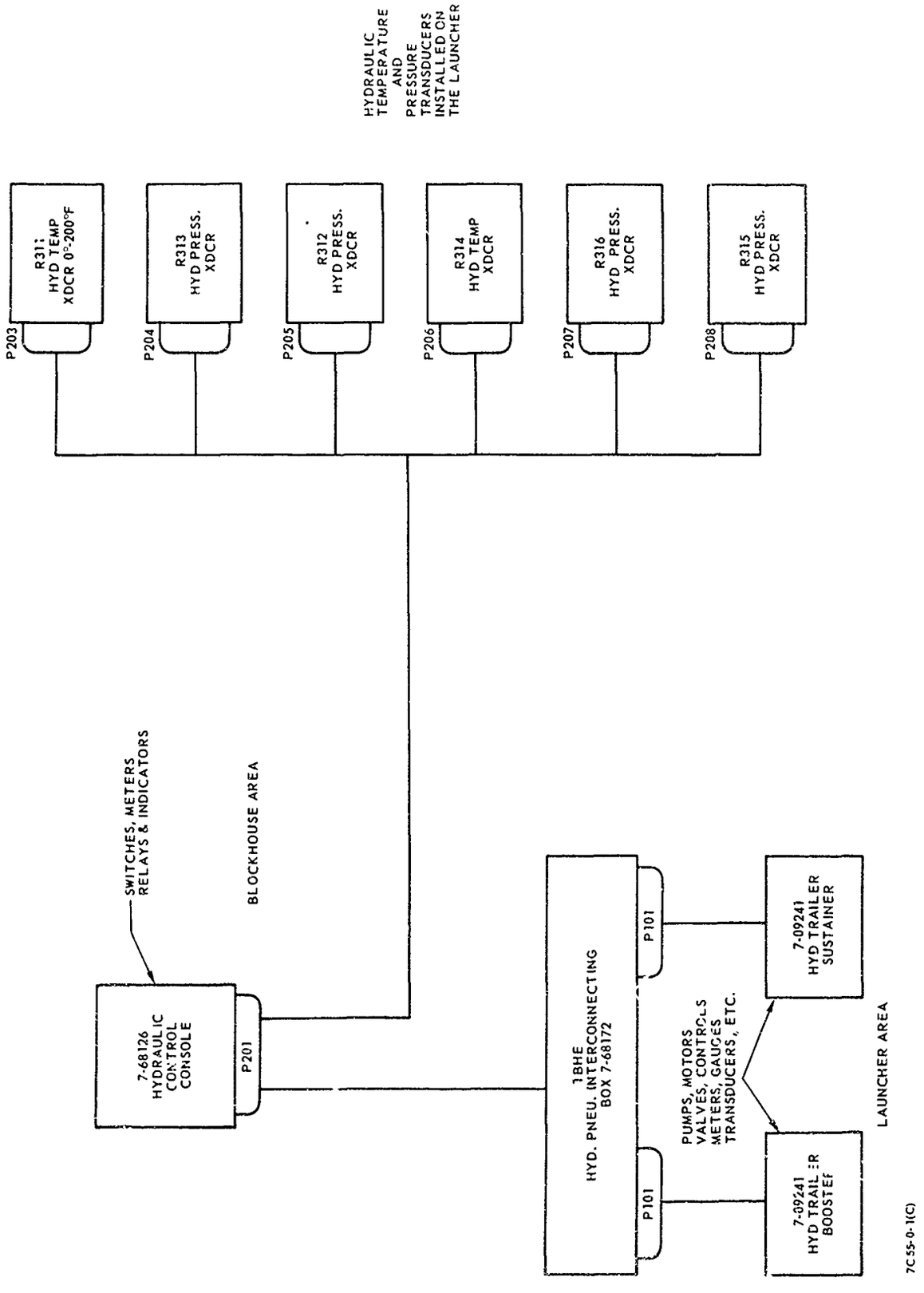
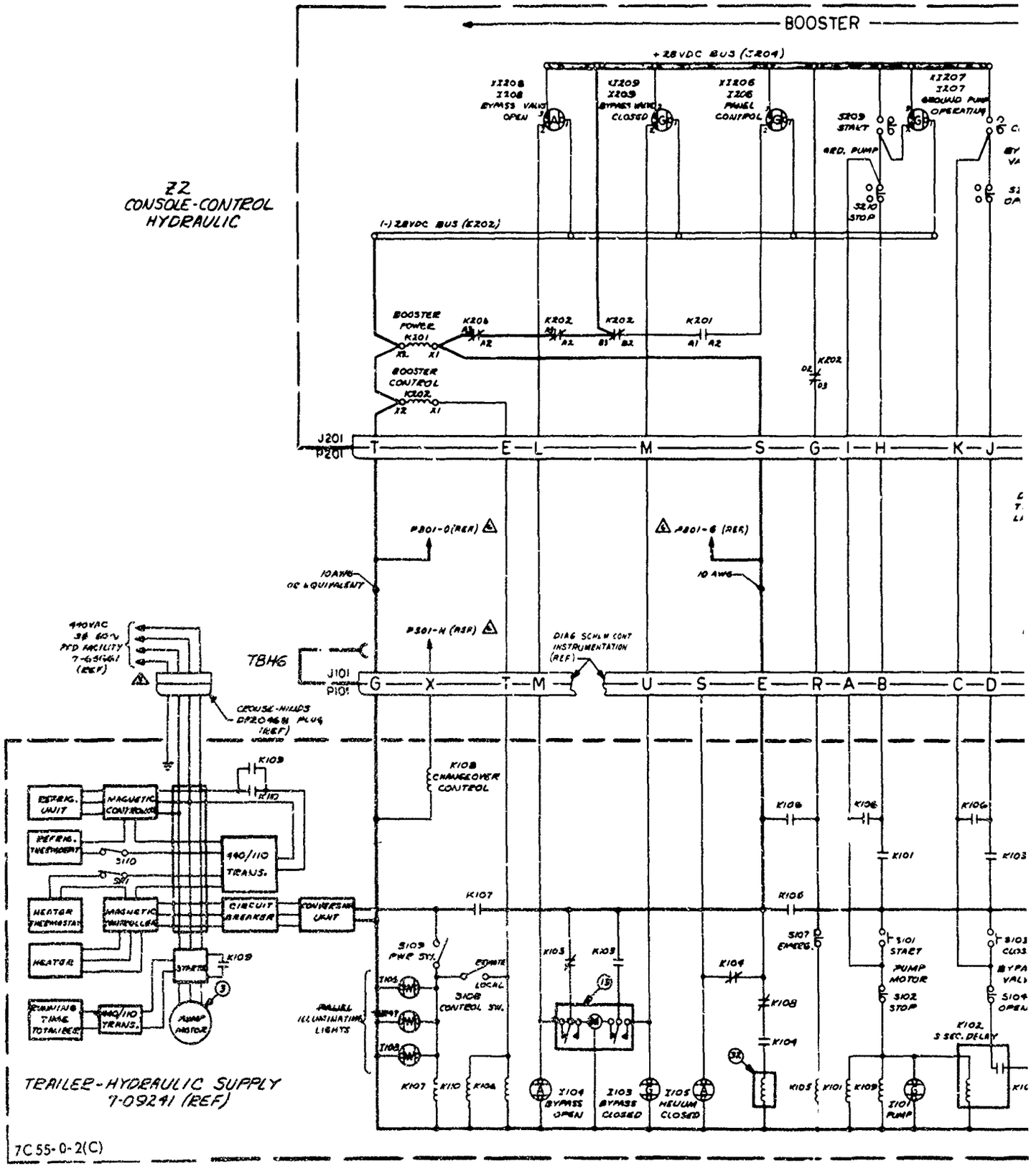
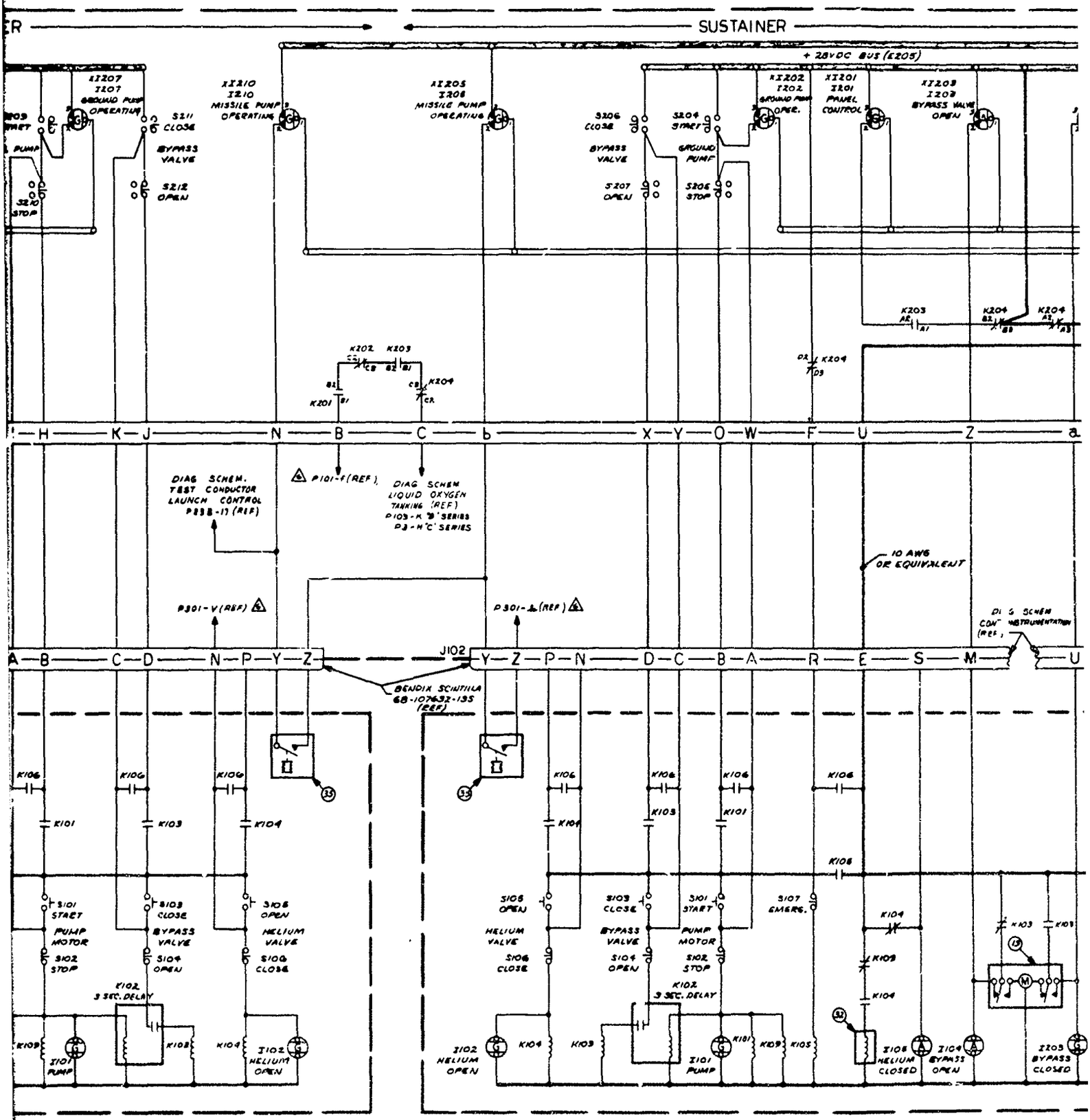


Figure 1-1. Hydraulic Supply and Control System


BOOSTER
+28VDC BUS (J204)
(-) 28VDC BUS (K202)
ZZ
CONSOLE-CONTROL
HYDRAULIC
BOOSTER POWER
BOOSTER CONTROL
J201
P201
J101
P101
TBH6
10 AWG OR EQUIVALENT
10 AWG
DIAG SCHEM CONT INSTRUMENTATION (REF)
CROUSE-HINDS DP20461 PLUG (REF)
K108 CHANGEOVER CONTROL
440/110 TRANS.
CIRCUIT BREAKER
CONTACTOR UNIT
HEATER
PUMP MOTOR
PARALLEL ILLUMINATING LIGHTS
S108 CONTROL SW.
S109 PWR SW.
S107 EMERG.
S101 START
PUMP MOTOR
S102 STOP
S103 START
S104 STOP
K102, 3 SEC. DELAY
Z104 BYPASS OPEN
Z103 BYPASS CLOSED
Z105 NEUTRAL CLOSED
Z101 PUMP
TRAILER-HYDRAULIC SUPPLY
7-09241 (REF)
7C 55-0-2(C)

A.



Figure

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B.

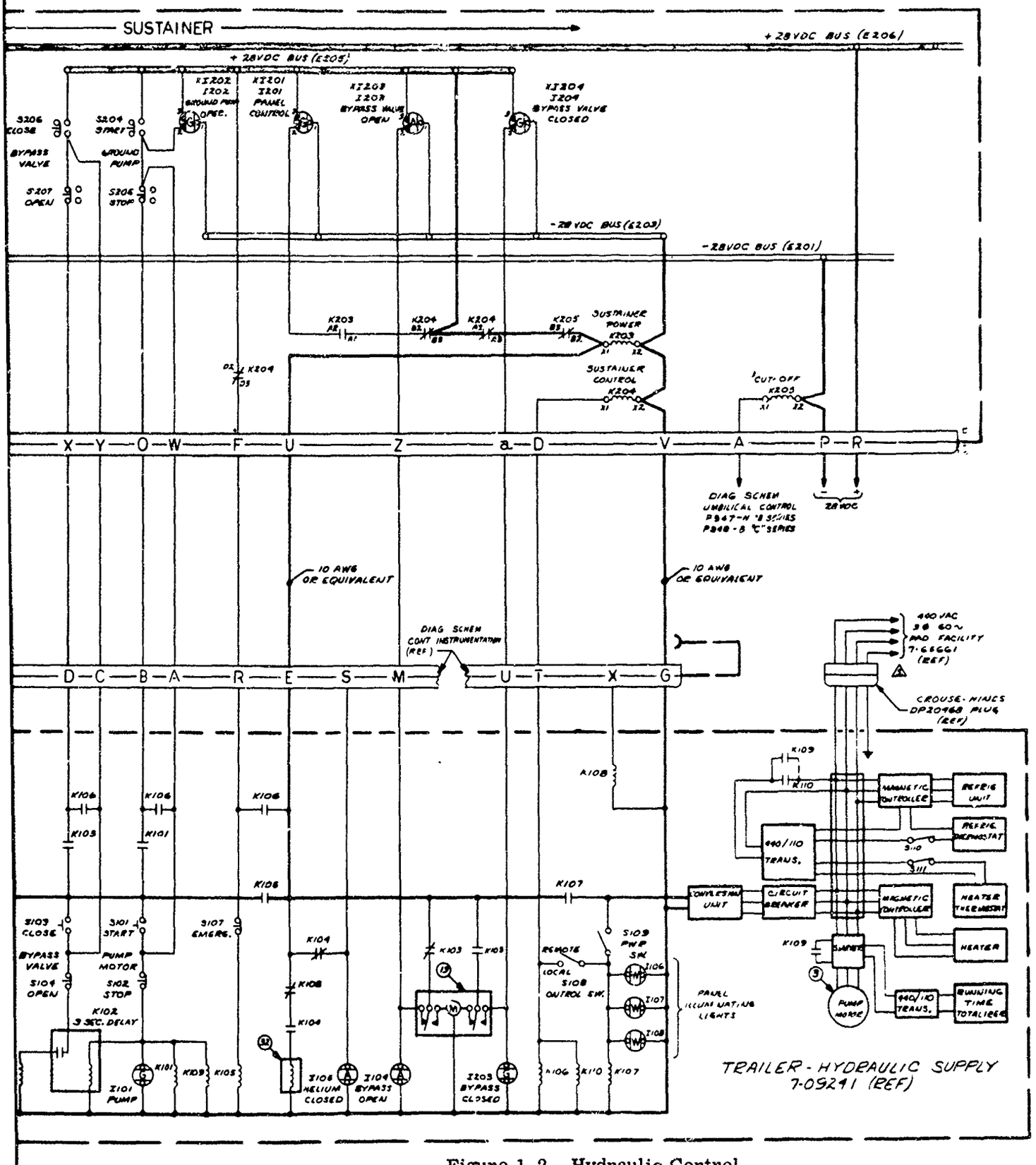


Figure 1-2. Hydraulic Control

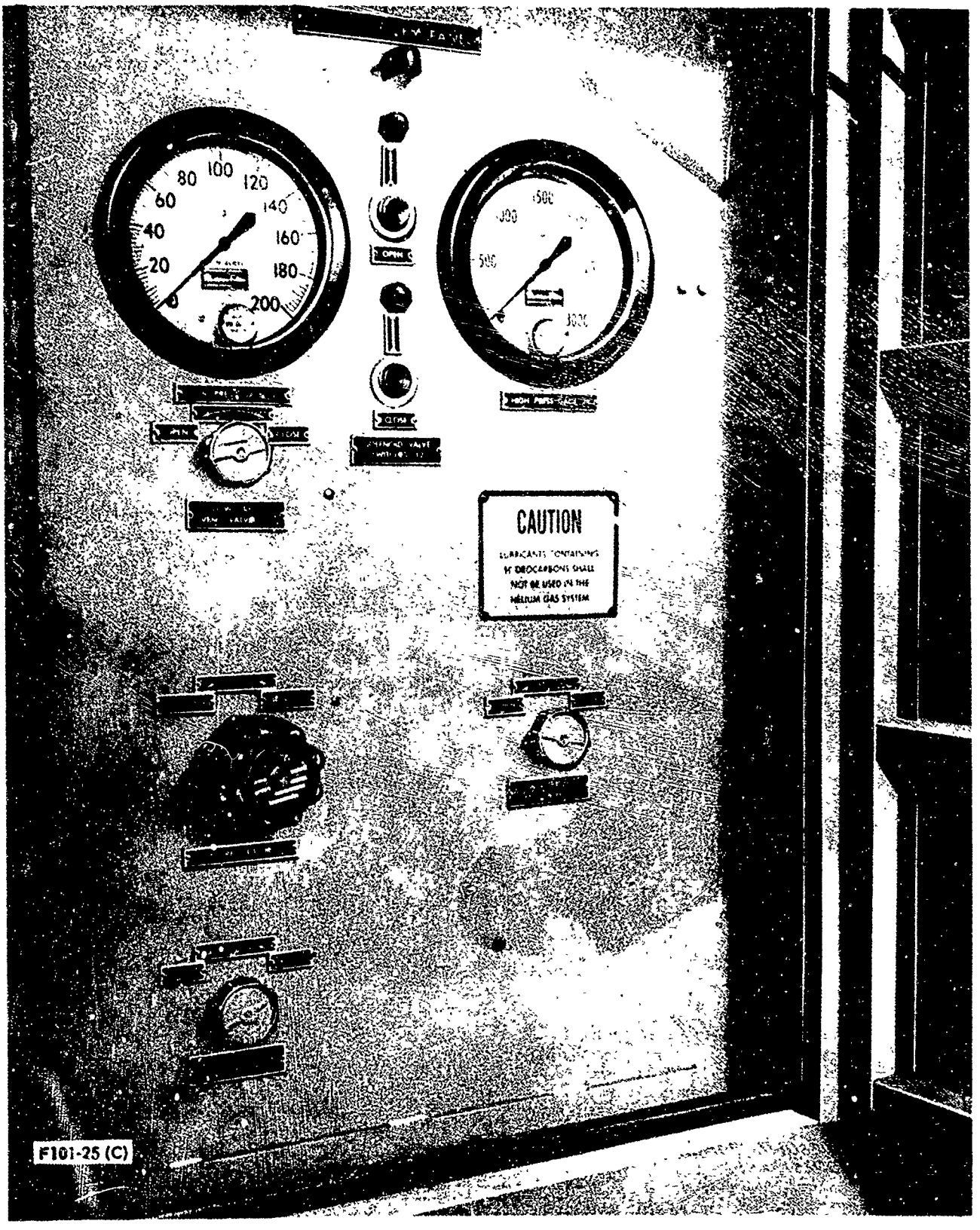
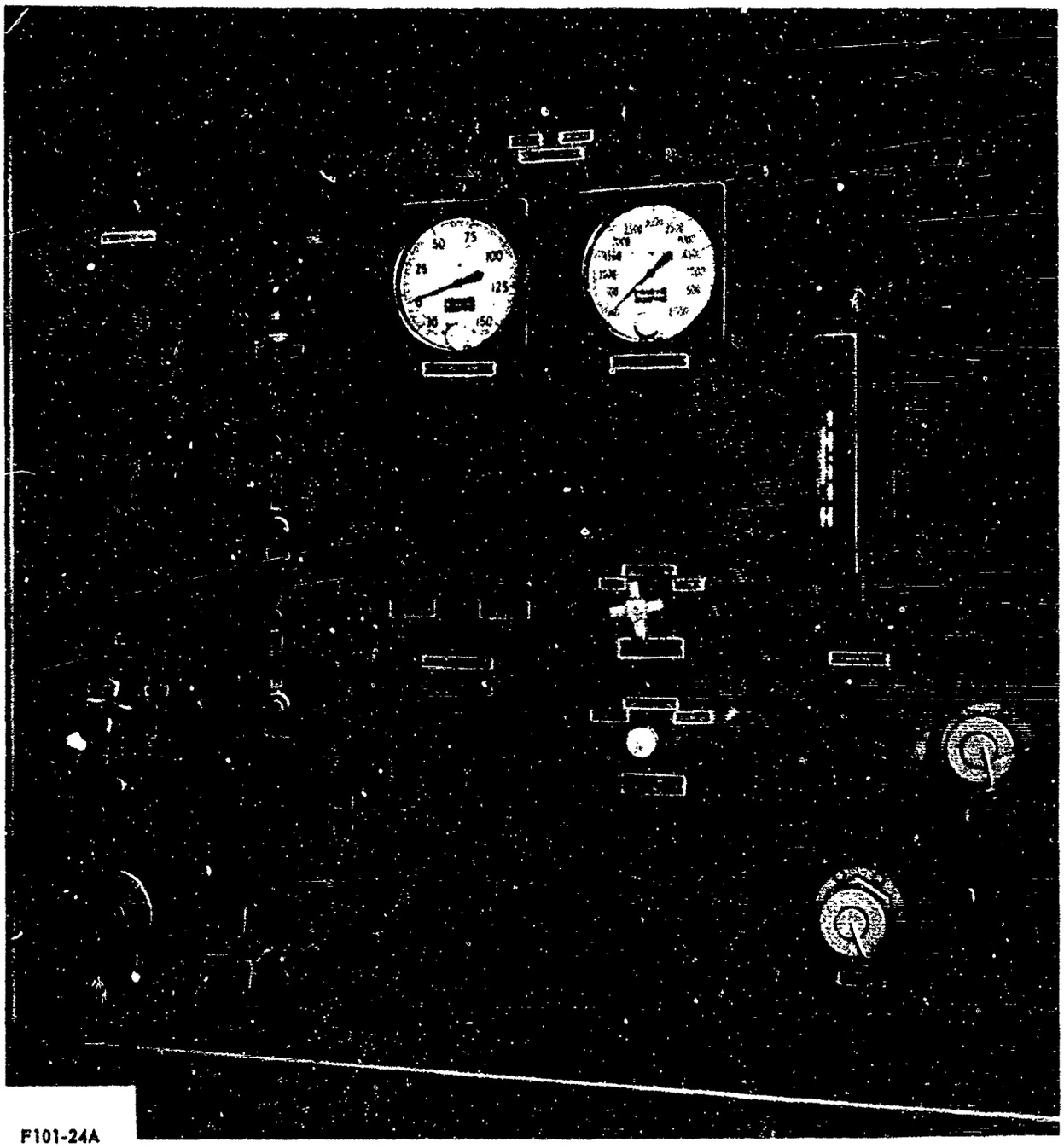


Figure 1-3. Helium System Control Panel



F101-24A

Figure 1-4. Hydraulic System Control Panel

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HYDRAULIC

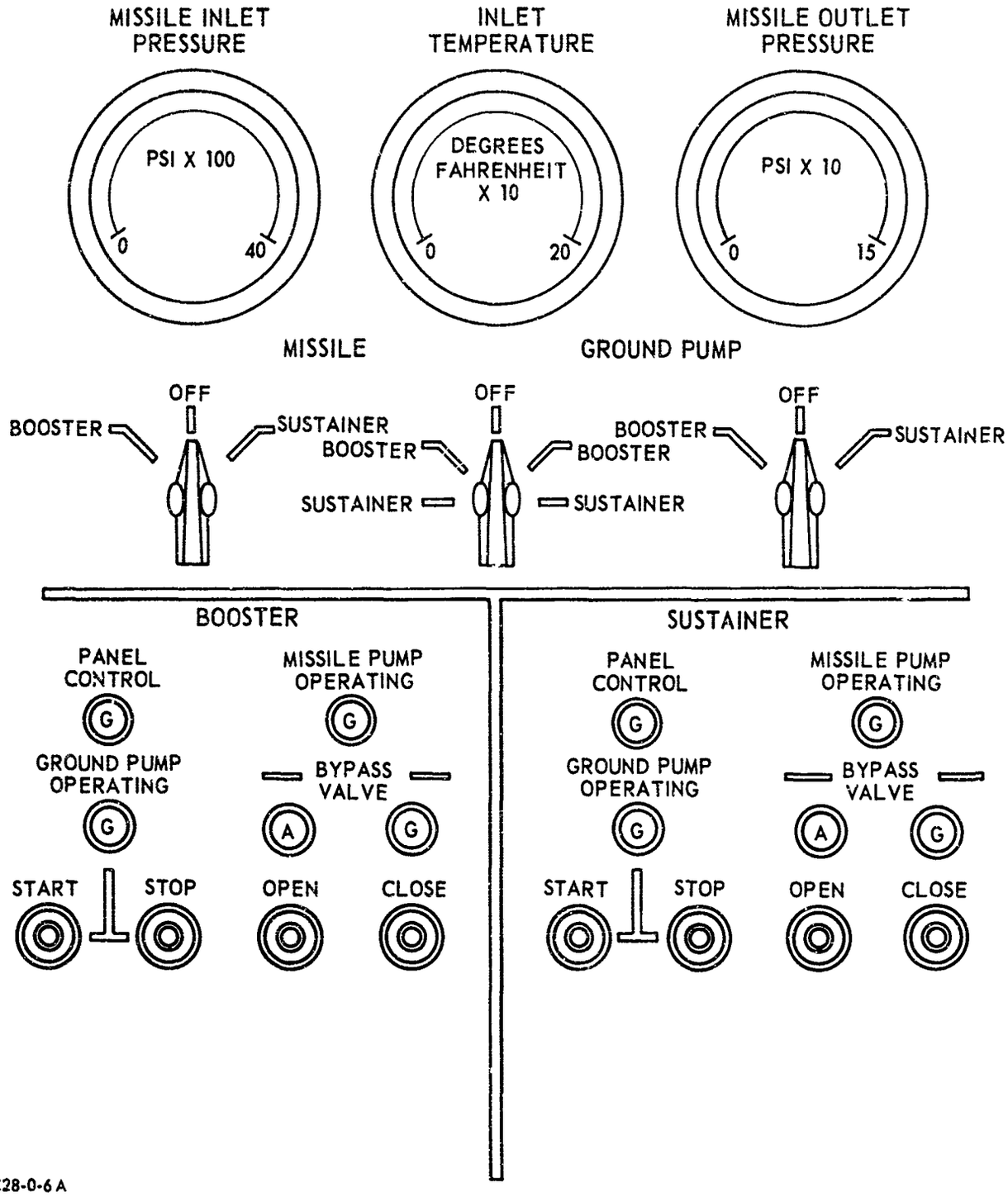

Figure 1-5. Blockhouse Hydraulic Control Panel

SECTION II

OPERATION

2-1. OPERATION OF HYDRAULIC CONTROL SYSTEM.

2-2. The following procedure is typical of either booster or sustainer control systems:

a. Local Procedure

1. Place S108 "local-remote" switch in "local" position.

2. Close hydraulic supply switch on pad facility console.

3. Close circuit breaker in hydraulic supply trailer.

4. Close S109 power switch on hydraulic supply trailer.

(a) Results of closing S109 power switch:

(1) Panel lights I106, I107, and I108 (W) on the trailer control panel come on.

(2) Bypass valve open lights I104 amber local and I208 amber remote come on.

(3) Remote control is inoperative.

5. Push S106 ground pump start button on the hydraulic supply trailer control panel.

(a) Result of depressed start button:

(1) Pump motor operating lights I101 (green) local and I207 (green) remote are energized.

6. After allowing three seconds for the pump motor to reach full speed, push S103, bypass valve close switch, on the hydraulic supply trailer control panel.

(a) Result of closed bypass valve switch:

(1) Bypass valve open lights I104 (amber) local and I208 (amber) remote come on.

(2) Bypass valve close lights I103 (green) local and I209 (green) remote come on.

7. After the booster hydraulic pump is operating, a pressure switch closes which transmits a ready signal. A similar action occurs in the sustainer system. The two pressure switches are interlocked and send the ready signal to the function safe panel located on the test conductors console.

b. Remote Procedure.

1. Place switch S108 (remote-local) on the hydraulic supply trailer control panel to remote. The results are as follows:

(a) Assume the pump motor is stopped and the bypass valve opened.

(b) The lights are in the condition as described in paragraph 2-2,a,4,(a).

(c) The panel control light I206 (green) is energized.

2. Push S207 ground pump start switch on the blockhouse control panel. The result is as follows:

(a) Ground pump operating lights I207 (green) on the blockhouse control panel and I101 (green) on the trailer control panel illuminate.

3. After three seconds, the pump motor will attain speed, then push S211 close bypass valve switch on the blockhouse control panel. The results are as follows:

(a) Bypass valve close lights I209 (green) and I103 (green) on the blockhouse control panel and on the hydraulic supply trailer control panel come on.

(b) Bypass valve open lights I208 (amber) on the blockhouse control panel and I104 (amber) on the hydraulic supply trailer control panel go out.

4. After the missile hydraulic pumps build up pressure to operational value, two pressure switches close, the results are as follows:

(a) A signal is generated to the test conductors console (function safe panel) indicating internal hydraulic safe.

(b) Missile pump operating lights I210 (green) and I205 (green) on the blockhouse control panel come on.

5. At missile flyaway, the umbilical eject two inch rise off signal shuts down the hydraulic trailers. The results are as follows:

(a) Ground pump operating lights (I207 and I101) (both green) on the blockhouse and supply trailer panels go out.

(b) Bypass valve close lights (I209 and I103) (both green) on the blockhouse and supply trailers go out.

(c) Bypass valve open lights (I208 and I104) (both amber) on the blockhouse and supply trailer panels come on.

6. At static firing sites, the ground hydraulic supply of 2000 psig standby, is maintained throughout the test.

NOTE

When emergency switch S107, on the supply trailer panel, is depressed, the hydraulic trailer shuts down and the light indications are same as in paragraph 2-2,b,5.

2-3. CONTROL PANEL METERS.

2-4. LOCAL - HYDRAULIC SUPPLY TRAILER.

2-5. BLOCKHOUSE CONTROL PANEL. (See table 2-1.)

2-6. INDICATING SYSTEM.

2-7. Each indicating system (see figure 2-1) consists of a transducer, calibration panel, and a 100-microamp dc meter. This meter is shunted to give a full scale deflection of one milliamp (dc). Provisions for connecting a one milliamp Esterline Angus Recorder are available on the calibration panel.

Table 2-1. Functions of Blockhouse Control Panel Meters

UNIT	FUNCTION(S)	RANGE
M201 Missile Outlet Pressure	Booster and Sustainer	(0-150 psi)
M202 Inlet Temp	Missile-Booster & Sustainer, Ground Pump-Booster & Sustainer	(0 - 200 F)
M203 Missile Inlet Pressure	Booster & Sustainer	(0-4000 psi)

NOTE

If recorders are not connected, a 1500 ohm one watt resistor should be connected across the proper terminals of the calibration panel. (See figure 2-1.)

2-8. CALIBRATION PANELS. The calibration panels for the temperature and pressure indicating assemblies are situated in the rack beneath the console panels located in the blockhouse. A schematic of the Twin Temperature Recorder Panel is shown in figure 2-2. A schematic of the Twin Pressure Recorder is shown in figure 2-3.

2-9. PRESSURE TRANSDUCERS. The pressure transducers are of the potentiometer type, having a total element resistance of 1000 ohms. This value must be used for the transducers to be compatible with the calibration system.

2-10. TEMPERATURE TRANSDUCERS. The temperature transducers are the resistance probe type, wound with balco wire. They have a nominal resistance of 1815 ohms at 77 F.

2-11. TRANSDUCER EXCITATION POWER. Transducer excitation voltage (28 v, dc) is supplied from a regulated power supply located per site requirements.

2-12. CALIBRATING INSTRUCTIONS.

a. For pressure indicating system.

1. Mechanically set the panel meter to zero.

2. Connect a pressure source to the transducer. Source must have a pressure gage.

3. Set the full scale adjust (FS ADJ) to maximum resistance. Turn the CALIB OFF RUN switch to RUN and apply 28 volts dc.

4. With zero pressure on the transducer, turn the ZERO ADJ set screw until the meter registers zero.

5. Increase the source pressure to the desired full scale reading. Do not exceed the pressure rating of the transducer.

6. Turn the full scale adjust (FS ADJ) set screw until the meter reads full scale.

7. Place the CALIB OFF RUN switch to CALIB.

8. Adjust the CALIB STD dial until the meter reads on the second major division below full scale.

9. Lock CALIB STD dial. The system now has an internal calibration checkpoint.

10. To calibrate, place the CALIB OFF RUN switch to CALIB.

11. Adjust the full scale adjust (FS ADJ) set screw so that the meter reads below full scale on the second major division.

NOTE

Do not move the CALIB STD dial from its set position unless it is necessary to change full scale pressure of the system.

12. Hold the CALIB RUN switch to RUN and the system is ready for operation.

b. For temperature indicating system.

1. Mechanically set panel meter to zero.

2. Connect a variable resistance (0-5000 ohms) to the system in place of the transducer.

3. Set the full scale adjust (FS ADJ) set screw to maximum resistance. Place the CALIB OFF RUN switch to RUN and apply 28 volts dc.

4. Set the variable resistance to a value equal to the probe resistance at 0° F. Setting is approximately 1500 ohms determined from the transducer calibration curve.

5. Turn the ZERO ADJ set screw until the meter reads zero.

6. Increase the variable resistance until it equals the resistance of the probe at 200 F. Setting is approximately 2400 ohms determined from the transducer calibration curve.

7. Turn the full scale adjust (FS ADJ) set screw until the meter reads full scale.

8. Place the CALIB OFF RUN switch to CALIB position.

9. Adjust the CALIB STD dial until the meter reads below full scale on the second major division.

10. Lock the CALIB STD dial. System now has an internal calibration check point.

11. To calibrate, place the CALIB OFF RUN switch to the CALIB position.

12. Adjust the full scale adjust (FS ADJ) set screw so the panel meter registers on the second major division below full scale.

NOTE

Do not move the CALIB STD dial from its set position unless it is necessary to change the full scale reading of the system.

13. Place the CALIB RUN switch to RUN position and the system is ready for operation.

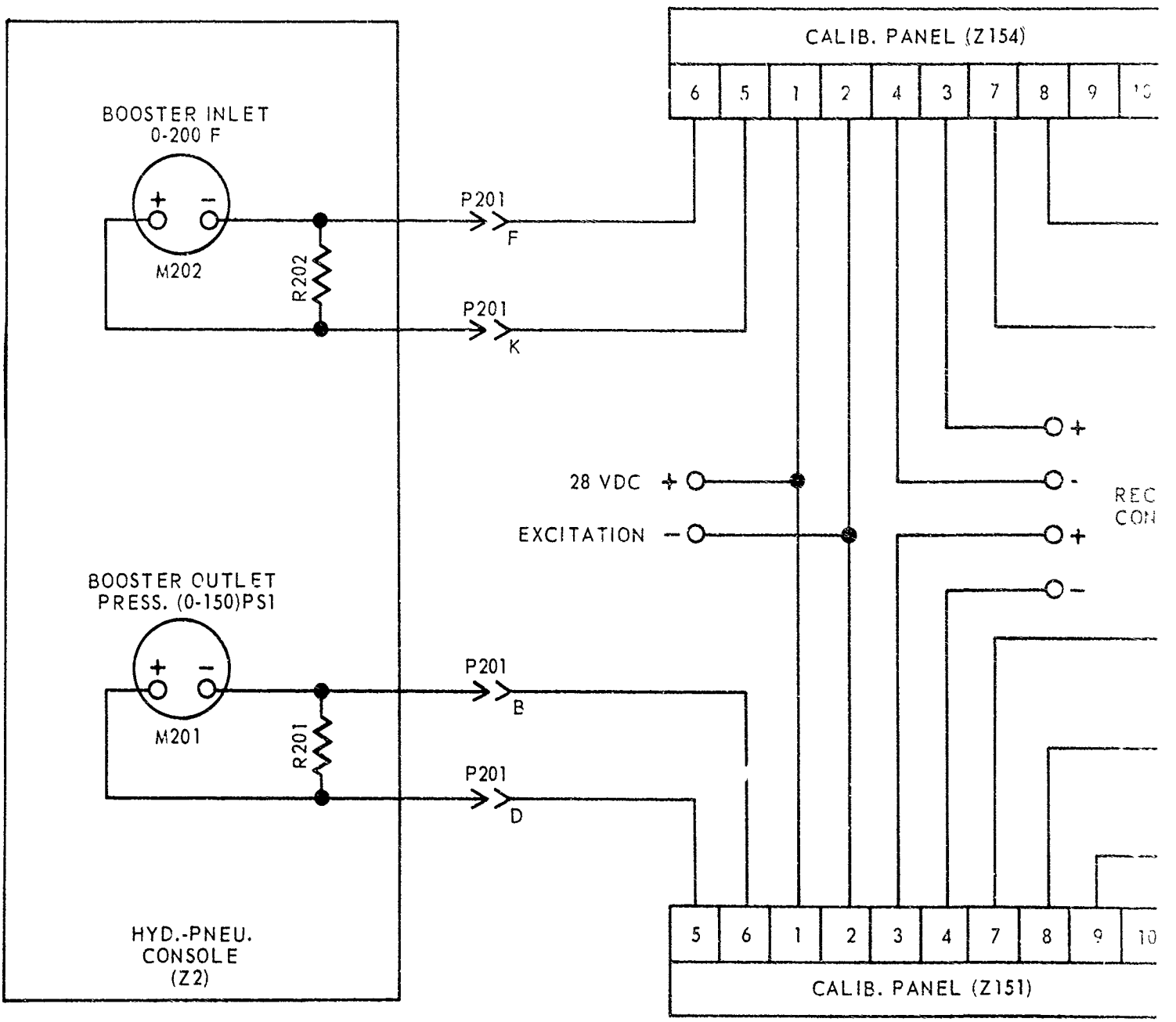

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Figure 2-1. T

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A.

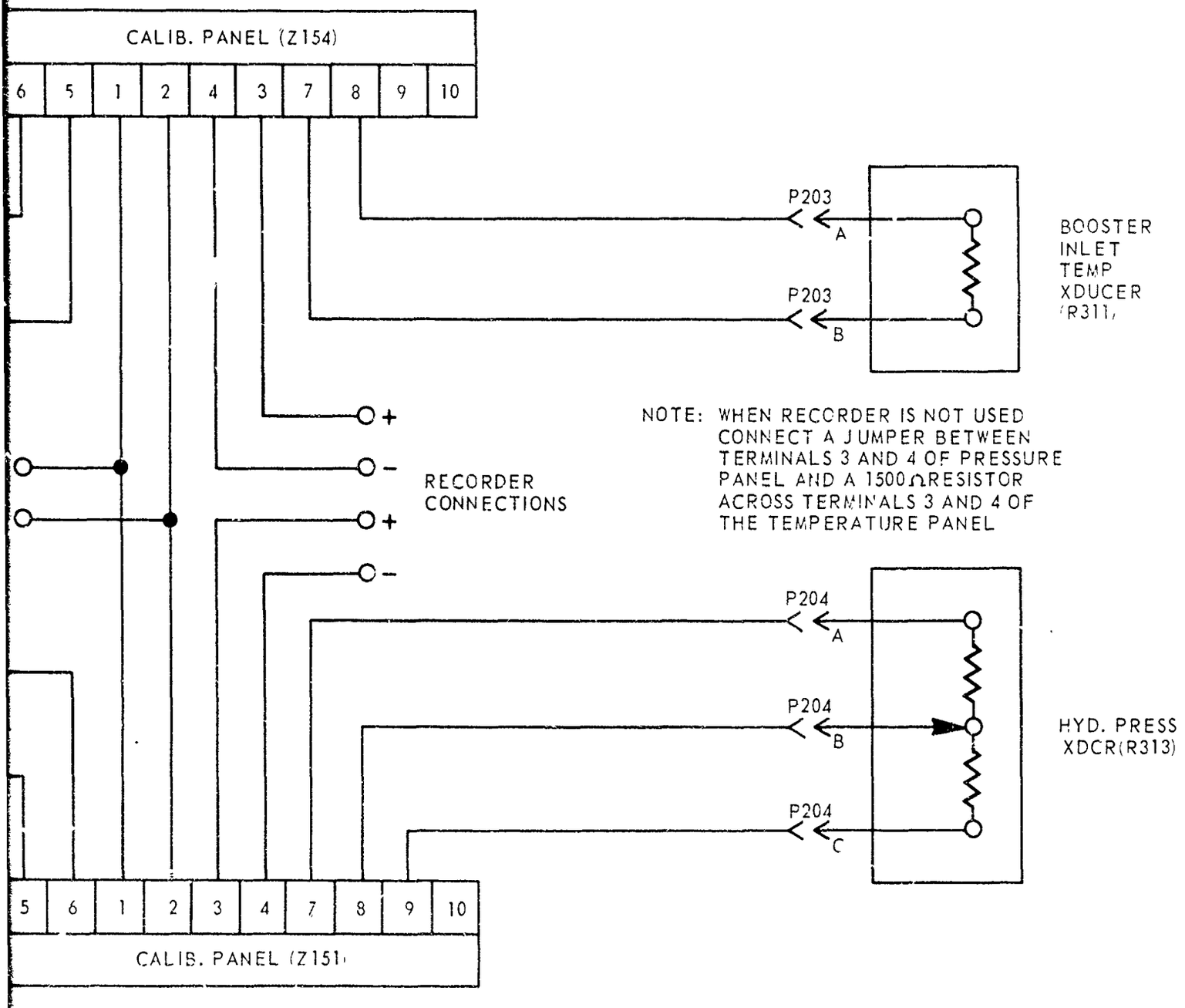

Figure 2-1. Typical Hydraulic Temperature and Pressure Indicating System

B.

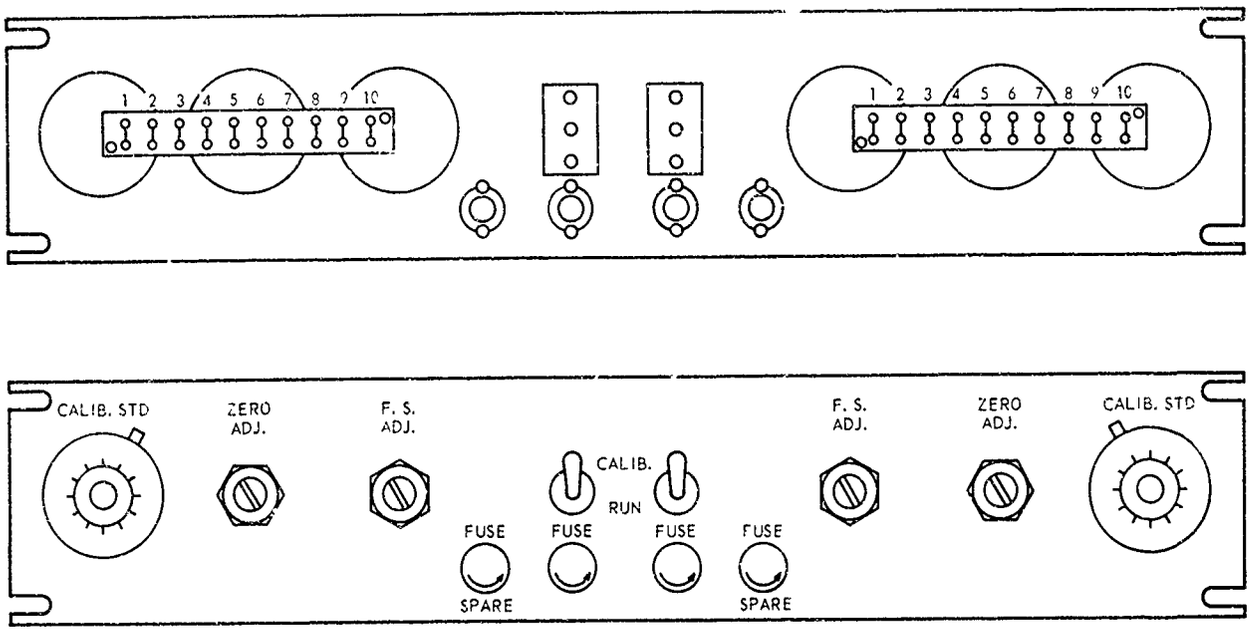

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Figure 2-2. Panel Calibrating Twin Temperature Recorder

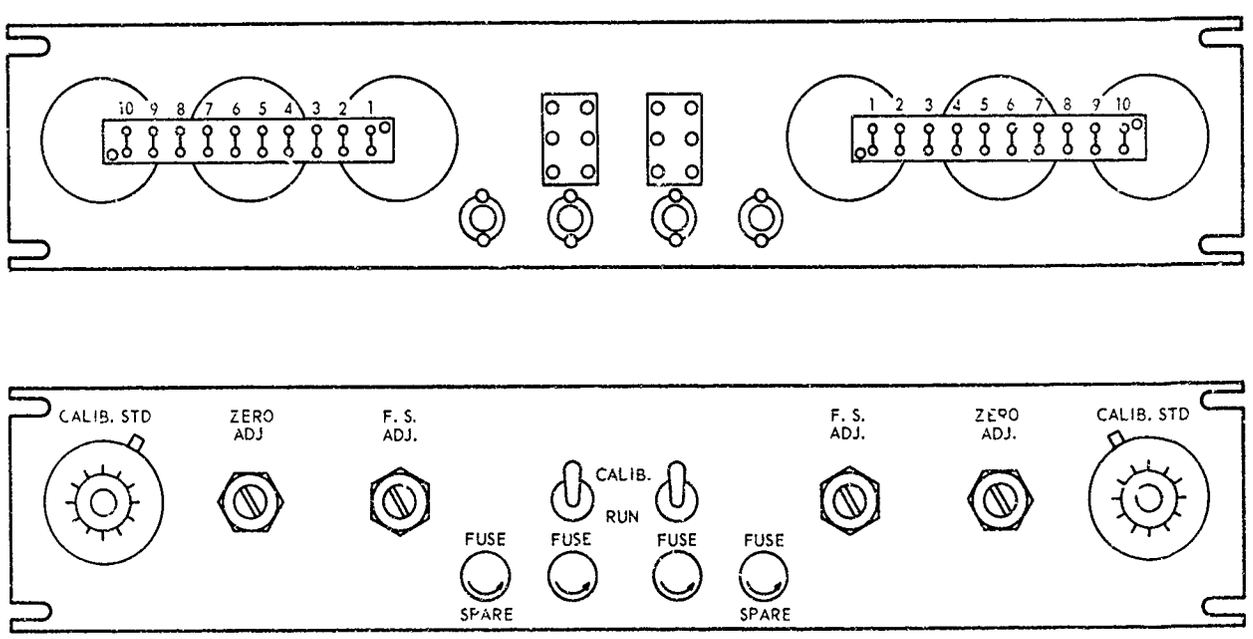

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Figure 2-3. Panel Calibrating Twin Pressure Recorder